

AI-Augmented Project-Based Learning Framework for Software Analysis and Design Education: A Multi-Cohort Empirical Study

Ibrahim Adeshola

Final International University, Faculty of Engineering, Via Mersin 10, Turkey

Abstract

This study develops and evaluates an AI-augmented project-based learning framework for software analysis and design education using archival evidence from a single institution's multi-cohort implementation. The dataset comprises 136 enrolment records representing 136 undergraduate students across three departments course delivered between Fall 2023 to Fall 2025. The analytical corpus includes 136 official course grade records, ensuring direct alignment between enrolments and observed academic outcomes. Students engaged with generative AI tools across requirements analysis, UML modelling, iterative design refinement, coding support, and technical documentation, while instructional oversight ensured validation, assessment integrity, and appropriate use of AI-generated outputs. The study used a quantitative-dominant mixed-method design based on document analysis, descriptive statistics, and pattern interpretation. The aggregated dataset includes 105 software engineering students, 14 computer engineering students, and 17 management information systems students. Therefore, the performance trends indicate that a substantial proportion of students achieved mid- to high-grade bands, particularly within project-based components, while greater variability was observed in examination-oriented assessments. Project deliverables, especially documentation, system design articulation, and demonstration, consistently produced stronger outcomes, suggesting that AI-supported workflows enhance clarity, iteration, and communication of design solutions. Based on these findings, the study proposes the AI Augmented Software Analysis and Design Learning Framework, a six-phase model that supports the responsible integration of generative AI into software engineering education. The framework emphasizes the balance between AI-assisted productivity and human oversight, preserving critical thinking, validation, and academic integrity, and offers a transferable model for similar educational contexts.

Keywords: Generative-AI; Real Project; Requirements Analysis; Software Engineering Education; Software Development.